

**TITLE 8:**  
**CONSTRUCTION SAFETY ORDERS**  
**Chapter 4, Subchapter 4, Articles 19, 20, 24, and 29;**  
**Sections 1632, 1635, 1671, 1709, and 1710, and New Section 1716.2**

**Safety Standards for Steel Erection**

Heard at the January 17, 2002, Public Hearing  
Adopted on March 21, 2002  
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Effective May 1, 2002

**STANDARDS PRESENTATION**  
**TO**  
**CALIFORNIA OCCUPATIONAL SAFETY AND HEALTH STANDARDS BOARD**

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Construction Safety Orders

Article 19. Floor, Roof, and Wall Openings

Amend Section 1632(b) to read:

§1632. Floor, Roof, and Wall Openings to Be Guarded.

(a) This section shall apply to temporary or emergency conditions where there is danger of employees or materials falling through floor, roof, or wall openings, or from stairways or runways.

(b) Floor, roof and skylight openings shall be guarded by a standard railing and toeboards or cover. Covering shall be capable of safely supporting the greater of the weight of a 200-pound person or twice the weight of worker(s) and material(s) placed thereon ~~on the employees, equipment and materials that may be imposed on the cover at any one time.~~ Covering shall be secured in place to prevent accidental removal or displacement, and shall bear a pressure sensitized, painted, or stenciled sign with legible letters not less than one inch high, stating: "Opening-Do Not Remove." Markings of chalk or keel shall not be used. In general, the railing shall be provided on all exposed sides, except at entrances to stairways.

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NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 20. Temporary Floors

Amend Section 1635 to read:

§1635. Floors, Walls and Structural Steel Framed Buildings.

(a) For multifloor buildings, other than structural steel framed buildings, the following shall apply:

(1) Every building shall have the joists, beams, or girders of floors below the floor or level where any work is being done, or about to be done, covered with flooring laid close together, or with other suitable material to protect workers engaged in such building from falling through joists or girders, and from falling substances, whereby life or safety is endangered.

(2) Every building which is of reinforced concrete construction, with reinforced concrete floors, shall have the floor filled in, either with forms or concrete, on each floor before the commencement of work upon the walls of the second floor above or the commencement of work upon the floor of the next floor above.

(3) Every building having wooden floors other than a steel frame building shall have the underflooring, if double flooring is to be used, laid on each floor within the time prescribed above for reinforced concrete floors. Where single wooden floors are to be used, each floor shall be planked over within the time prescribed above for reinforced concrete floors.

(4) If a span of a floor on a building exceeds 13 feet, an intermediate beam shall be used to support the temporary flooring, but spans not to exceed 16 feet may be covered by three-inch planks without an intermediate beam. The intermediate beam shall be of a sufficient strength to sustain a live load of 50 pounds per square foot of the area supported.

(5) If building operations are suspended and the temporary flooring required by this article is removed, the building shall be replanked upon the resumption of work so that every worker at work has a covered floor not more than two stories below.

(6) Planked floors on buildings shall be tightly laid together of proper thickness, grade and span to carry the working load; such working load to be assumed as at least 25 pounds per square foot.

(7) ~~Safety belts and nets~~ Fall protection shall be required in accordance with Article 24.

(8) No person shall proceed with any work assigned to or undertaken or require or permit any other person to proceed with work assigned to or undertaken by either, unless the planking or nets required by this article are in place.

(b) For multifloor structural steel framed buildings more than two stories high, the following shall apply: These provisions shall apply to buildings erected in tiers or stories and shall not apply to steel framed buildings having large open spans or areas such as, mill buildings, gymnasiums, auditoriums, hangars, arenas, or stadiums.

(1) The derrick or working floor of every building shall be solidly decked over its entire surface except for access openings.

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- (2) There shall be a tight and substantial temporary floor within two floors below and directly under that portion of each tier of beams on which erection, riveting, bolting, welding or painting is being done. For operations of short duration of exposure to falling, ~~safety belts~~ fall protection shall be required as set forth in Article 24.
- (3) Temporary floors shall be wood planking of proper thickness, grade and span to carry the working load, but shall not be less than two inches thick, full size undressed.
- (4) Provision shall be made to secure temporary flooring against displacement by strong winds or other forces.
- (5) Planks shall extend a minimum of 12 inches beyond centerline of their supports at each end.
- (6) Wire mesh or plywood (exterior grade) shall be used to cover openings adjacent to columns where planks do not fit tightly. The materials used must be of sufficient strength as required by Section 1632(b) to provide fall protection for personnel and prevent objects from falling through.
- (7) Metal decking where used in lieu of wood planking shall be of equivalent strength and shall be laid tightly and secured to prevent movement.
- (8) Floor planks that are temporarily removed for any reason whatsoever shall be replaced as soon as work requiring their removal is completed or the open area shall be properly guarded.
- (9) Prior to removal of temporary floor plank, employees shall be instructed by assigned supervision the steps to be taken to perform the work safely and in proper sequence.
- (10) When gathering and stacking temporary floor plank on a lower floor, in preparation for transferring such plank for use on an upper working floor, the steel erector's personnel shall remove such plank successively, working toward the last panel of such floor, so that the work is always being done from the planked floor.
- (11) When gathering and stacking temporary floor planks from the last panel, the steel erector's personnel assigned to such work shall be protected by safety belts with life lines attached to a catenary line or other substantial anchorage.
- (12) The sequence of erection, bolting temporary guying, riveting and welding shall be such as to maintain the stability of the structural frame at all times during construction. This applies to the dead weight of the structure, plus weight and working reactions of all construction equipment placed thereon plus any external forces that may be applied.
- (13) Where a building is being constructed in sections, each section constitutes a building.
- (14) Personal fall protection and nets shall be required in accordance with Article 24.
- (15) No person shall proceed with any work assigned to or undertaken by him, or require or permit any other person to proceed with the work assigned to or undertaken by either, unless the planking or nets required by this article are in place.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Sections 142.3, 5260, 7101, 7102, 7103, 7104, 7105, 7107, 7108, 7109, 7251, 7252, 7253, 7254, 7255, 7256, 7257, 7258, 7259, 7261, 7262, 7263, 7264, 7265 and 7266, Labor Code.

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Article 24. Fall Protection  
Amend Section 1671 to read:

§1671. Safety Nets.

(a) Where the elevation is 25 feet or more above the ground, water surface, or continuous floor level below, and when the use of personal fall arrest systems, personal fall restraint systems, positioning device systems or more conventional types of protection are clearly impractical, the exterior and/or interior perimeter of the structure shall be provided with an approved safety net extending at least 8 feet horizontally from such perimeter and being positioned at a distance not to exceed 10 feet vertically below where such hazards exist, or equivalent protection provided safety nets shall extend outward from the outermost projection of the work surface as follows:

<i>Vertical distance from working level to horizontal plane of net.</i>	<i>Minimum required horizontal distance of outer edge of net from the edge of working surface.</i>
Up to 5 feet	8 feet
More than 5 feet up to 10 feet-	10 feet
More than 10 feet but not to exceed 30 feet	13 feet

Nets shall be hung with sufficient clearance to prevent user's contact with the surfaces or structures below. Such clearances shall be determined by impact load testing.

EXCEPTION: See Section 1709(c) and 1710 (k) and (l) ~~(d), (e) and (f)~~ for flooring requirements and nets for steel erection in tiered buildings and structures.

(b) Only one level of nets shall be required for bridge construction.

(c) Safety nets purchased on or after January 1, 1998 shall be labeled as meeting the requirements of American National Standards Institute (ANSI) A10.11-1989, American National Standard for Construction and Demolition Operations - Personnel and Debris Nets, Repair and Demolition Operations. Safety nets purchased before January 1, 1998 shall be labeled as meeting the requirements of ANSI A10.11-1979, Safety Nets Used During Construction, Repair and Demolition Operations, or ANSI A10.11-1989.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Article 29. Erection and Construction

Amend Section 1709 to read:

§1709. ~~Overloading Prohibited.~~ General Requirements.

(a) No building, structure, or part thereof, or any temporary support or scaffolding in connection therewith shall be loaded in excess of its designed capacity.

(b) Bracing.

(1) Trusses and beams shall be braced laterally and progressively during construction to prevent buckling or overturning.

(2) The first member shall be plumbed, connected, braced and/or guyed against shifting before succeeding members are erected and secured to it.

(3) The total system shall be adequately braced and stabilized to the foundation, to suitable anchors buried in the ground, or by other equivalent method(s).

(4) Beams, trusses and other material being lifted and placed by cranes or other hoisting apparatus shall not be released from the crane or hoisting apparatus until the person detaching the load has verified that the load has been secured or supported to prevent inadvertent movement.

(c) Wood Floor Construction.

(1) In the erection of a building having double wood floor construction, the rough flooring shall be completed as the building progresses, including the tier below the one on which floor joists are being installed.

(2) For single wood floor or other flooring systems, the floor immediately below the story where the floor joists are being installed shall be kept planked or decked over.

(d) Erection Guide for Trusses and Beams Over 25 Feet Long. The employer shall provide an erection plan and procedure prepared by a civil engineer currently registered in California which shall be followed and kept available on the job site for inspection by the Division.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Amend Section 1710 to read:

§ 1710. ~~Erection of Structures.~~ Structural Steel Erection.

~~(a) Bracing.~~

~~(1) Trusses and beams shall be braced laterally and progressively during construction to prevent buckling or overturning.~~

~~(2) The first member shall be plumbed, connected, braced and/or guyed against shifting before succeeding members are erected and secured to it.~~

~~(3) The total system shall be adequately braced and stabilized to the foundation, to suitable anchors buried in the ground, or by other equivalent method(s).~~

~~(4) Beams, trusses and other material being lifted and placed by cranes or other hoisting apparatus shall not be released from the crane or hoisting apparatus until the person detaching the load has verified that the load has been secured or supported to prevent inadvertent movement.~~

~~(b) Erection Guide for Trusses and Beams Over 25 Feet Long. The employer shall provide an erection plan and procedure prepared by a civil engineer currently registered in California which shall be followed and kept available on the job site for inspection by the Division.~~

(a) Scope and application.

(1) This section sets forth requirements to protect employees from the hazards associated with steel erection activities involved in the construction, alteration, and/or repair of single and multi-story buildings, bridges, and other structures where steel erection occurs. The requirements of this section apply to employers engaged in steel erection unless otherwise specified.

EXCEPTION: This section does not cover electrical transmission towers, communication and broadcast towers, or tanks.

NOTE: Additional requirements for work on steel framed structures are contained in Article 20, Section 1635(b) of these orders.

(2) Steel erection activities include hoisting, connecting, welding, bolting, and rigging structural steel, steel joists and metal buildings; installing metal deck, siding systems, miscellaneous metals, ornamental iron and similar materials; and moving from point-to-point to perform these activities.

(3) The duties of controlling contractors under this section include, but are not limited to, the duties specified in (c)(1) & (3), (f)(2)(B), (j)(2) and (n) of this section.

(b) Definitions.

“Anchored bridging” means that the steel joist bridging is connected to a bridging terminus point.

“Bolted diagonal bridging” means diagonal bridging that is bolted to a steel joist or joists.

“Bridging clip” means a device that is attached to the steel joist to allow the bolting of the bridging to the steel joist.

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“Bridging terminus point” means a wall, a beam, tandem joists (with all bridging installed and a horizontal truss in the plane of the top chord) or other element at an end or intermediate point(s) of a line of bridging that provides an anchor point for the steel joist bridging.

“Cold forming” means the process of using press brakes, rolls, or other methods to shape steel into desired cross sections at room temperature.

“Column” means a load-carrying vertical member that is part of the primary skeletal framing system. Columns do not include posts.

“Constructibility” means the ability to erect structural steel members in accordance with Section 1710 without having to alter the over-all structural design.

“Construction load” (for joist erection) means any load other than the weight of the employee(s), the joists and the bridging bundle.

“Controlling contractor” means a prime contractor, general contractor, construction manager or any other legal entity which has the overall responsibility for the construction of the project -- its planning, quality and completion.

“Decking hole” means a gap or void more than 2 inches (5.1 cm) in its least dimension and less than 12 inches (30.5 cm) in its greatest dimension in a floor, roof or other walking/working surface. Pre-engineered holes in cellular decking (for wires, cables, etc.) are not included in this definition.

“Derrick floor” (working floor) means an elevated floor of a building or structure that has been designated to receive hoisted pieces of steel prior to final placement.

“Double connection” means an attachment method where the connection point is intended for two pieces of steel which share common bolts on either side of a central piece.

“Double connection seat” means a structural attachment that, during the installation of a double connection, supports the first member while the second member is connected.

“Erection bridging” means the bolted diagonal bridging that is required to be installed prior to releasing the hoisting cables from the steel joists.

“Girt” (in systems-engineered metal buildings) means a "Z" or "C" shaped member formed from sheet steel spanning between primary framing and supporting wall material.

“Hoisting equipment” means commercially manufactured lifting equipment designed to lift and position a load of known weight to a location at some known elevation and horizontal distance from the equipment's center of rotation. "Hoisting equipment" includes but is not limited to cranes, derricks, tower cranes, barge-mounted derricks or cranes, gin poles and gantry hoist systems. A "come-a-long" (a mechanical device, usually consisting of a chain or cable attached at each end, that is used to facilitate movement of materials through leverage) is not considered "hoisting equipment."

“Metal decking” means a commercially manufactured, structural grade, cold rolled metal panel formed into a series of parallel ribs; for this section, this includes metal floor and roof decks, standing seam metal roofs, other metal roof systems and other products such as bar gratings, checker plate, expanded metal panels, and similar products. After installation and proper fastening, these decking materials serve a combination of functions including, but not limited to:



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a structural element designed in combination with the structure to resist, distribute and transfer loads, stiffen the structure and provide a diaphragm action; a walking/working surface; a form for concrete slabs; a support for roofing systems; and a finished floor or roof.

“Permanent floor” means a structurally completed floor at any level or elevation (including slab on grade).

“Project structural engineer of record” means the registered, California licensed engineer responsible for the design of structural steel framing and whose seal appears on the structural contract documents.

“Purlin” (in systems-engineered metal buildings) means a "Z" or "C" shaped member formed from sheet steel spanning between primary framing and supporting roof material.

“Safety deck attachment” means an initial attachment that is used to secure an initially placed sheet of decking to keep proper alignment and bearing with structural support members.

“Shear connector” means headed steel studs, steel bars, steel lugs, and similar devices which are attached to a structural member for the purpose of achieving composite action with concrete.

“Steel erection” means the construction, alteration or repair of steel buildings, bridges and other structures, including the installation of metal decking and all planking used during the process of erection.

“Steel joist” means an open web, secondary load-carrying member of 144 feet (43.9 m) or less, designed by the manufacturer, used for the support of floors and roofs. This does not include structural steel trusses or cold-formed joists.

“Steel joist girder” means an open web, primary load-carrying member, designed by the manufacturer, used for the support of floors and roofs. This does not include structural steel trusses.

“Steel truss” means an open web member designed of structural steel components by the project structural engineer of record. For the purposes of this section, a steel truss is considered equivalent to a solid web structural member.

“Structural steel” means a steel member, or a member made of a substitute material. These members include, but are not limited to, steel joists, joist girders, purlins, columns, beams, trusses, splices, seats, metal decking, girts, and all bridging, and cold formed metal framing which is integrated with the structural steel framing of a building.

“Systems-engineered metal building” means a metal, field-assembled building system consisting of framing, roof and wall coverings. Typically, many of these components are cold-formed shapes. These individual parts are fabricated in one or more manufacturing facilities and shipped to the job site for assembly into the final structure. The engineering design of the system is normally the responsibility of the systems-engineered metal building manufacturer.

“Tank” means a container for holding gases, liquids or solids.

(c) Site layout and construction sequence.

(1) Approval to begin steel erection. Before authorizing the commencement of steel erection, the controlling contractor shall ensure that the steel erector is provided with the following written notifications:

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(A) The concrete in the footings, piers and walls and the mortar in the masonry piers and walls has attained, on the basis of an approved test method of field-cured samples (i.e. appropriate ASTM standard test method), either 75 percent of the intended minimum compressive design strength or sufficient strength to support the loads imposed during steel erection.

(B) Any repairs, replacements and modifications to the anchor bolts were conducted in accordance with Section 1710(f)(2).

(2) Commencement of steel erection. A steel erection contractor shall not erect steel unless it has received written notification that the concrete in the footings, piers and walls or the mortar in the masonry piers and walls has attained, on the basis of an approved test method of field-cured samples (i.e., appropriate ASTM standard test method), either 75 percent of the intended minimum compressive design strength or sufficient strength to support the loads imposed during steel erection.

(3) Site layout. The controlling contractor shall ensure that the following is provided and maintained:

(A) Adequate access roads into and through the site for the safe delivery and movement of derricks, cranes, trucks, other necessary equipment, and the material to be erected and means and methods for pedestrian and vehicular control.

EXCEPTION: This requirement does not apply to roads outside of the construction site.

(B) A firm, properly graded, drained area, readily accessible to the work with adequate space for the safe storage of materials and the safe operation of the erector's equipment.

(4) Pre-planning of overhead hoisting operations. All hoisting operations in steel erection shall be pre-planned to ensure that the requirements of General Industry Safety Orders, Section 5002 are met.

(d) Hoisting and rigging.

(1) The crane or derrick operator shall be responsible for those operations under the operator's direct control. Whenever there is any doubt as to safety, the operator shall have the authority to stop and refuse to handle loads until safety has been assured.

(2) Bundle packaging and strapping shall not be used for hoisting unless specifically designed for that purpose.

(3) If loose items such as dunnage, flashing, or other materials are placed on the top of metal decking bundles to be hoisted, such items shall be secured to the bundles.

(4) Cranes or derricks may be used to hoist employees on a personnel platform when work under this section is being conducted, provided the provisions of General Industry Safety Orders, Section 5004 [except for subsection (c)] are met.

NOTE: Other applicable regulations pertaining to hoisting and rigging operations for the use of cranes and derricks in steel erection construction are contained in the General Industry Safety Orders, Group 13, Cranes and Other Hoisting Equipment.

(e) Walking/working surfaces.

(1) Shear connectors and other similar devices.

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(A) Tripping hazards. Shear connectors (such as headed steel studs, steel bars or steel lugs), reinforcing bars, deformed anchors or threaded studs shall not be attached to the top flanges of beams, joists or beam attachments so that they project vertically from or horizontally across the top flange of the member until after the metal decking, or other walking/working surface, has been installed.

(B) Installation of shear connectors on composite floors, roofs and bridge decks. When shear connectors are used in construction of composite floors, roofs and bridge decks, employees shall lay out and install the shear connectors after the metal decking has been installed, using the metal decking as a working platform.

(f) Column anchorage.

(1) General requirements for erection stability.

(A) All columns shall be anchored by a minimum of 4 anchor rods (anchor bolts).

(B) Each column anchor rod (anchor bolt) assembly, including the column-to-base plate weld and the column foundation, shall be designed to resist a minimum eccentric gravity load of 300 pounds (136.2 kg) located 18 inches (.46m) from the extreme outer face of the column in each direction at the top of the column shaft.

(C) Columns shall be set on level finished floors, pre-grouted leveling plates, leveling nuts, or shim packs which are adequate to transfer the construction loads.

(D) All columns shall be evaluated by a competent person to determine whether guying or bracing is needed; if guying or bracing is needed, it shall be installed.

(2) Repair, replacement or field modification of anchor rods (anchor bolts).

(A) Anchor rods (anchor bolts) shall not be repaired, replaced or field-modified without the approval of the project structural engineer of record.

(B) Prior to the erection of a column, the controlling contractor shall provide written notification to the steel erector if there has been any repair, replacement or modification of the anchor rods (anchor bolts) of that column.

(e) (g) Structural Steel Erection. Beams and columns.

(1) During the final placing of solid web structural members, the load shall not be released from the hoisting line until the members are secured with ~~not less than two bolts, or the equivalent at each connection to keep members from rolling and to sustain anticipated loads. Bolts shall be drawn up wrench tight.~~ at least two bolts per connection, of the same size and strength as shown in the erection drawings, drawn up wrench-tight or the equivalent as specified by the project structural engineer of record, except as specified in subsection (g)(3) of this section.

(2) A competent person shall determine if more than two bolts are necessary to ensure the stability of cantilevered members; if additional bolts are needed, they shall be installed.

(3) Diagonal bracing. Solid web structural members used as diagonal bracing shall be secured by at least one bolt per connection drawn up wrench-tight or the equivalent as specified by the project structural engineer of record.

(4) Double connections at columns and/or at beam webs over a column.

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(A) When two structural members on opposite sides of a column web, or a beam web over a column, are connected sharing common connection holes, at least one bolt with its wrench-tight nut shall remain connected to the first member unless a shop-attached or field-attached seat or equivalent connection device is supplied with the member to secure the first member and prevent the column from being displaced (See Appendix B of this section for examples of equivalent connection devices).

(B) If a seat or equivalent device is used, the seat (or device) shall be designed to support the load during the double connection process. It shall be adequately bolted or welded to both a supporting member and the first member before the nuts on the shared bolts are removed to make the double connection.

(5) Column splices. Each column splice shall be designed to resist a minimum eccentric gravity load of 300 pounds (136.2 kg) located 18 inches (.46 m) from the extreme outer face of the column in each direction at the top of the column shaft.

(6) Perimeter columns. Perimeter columns shall not be erected unless:

(A) The perimeter columns extend a minimum of 48 inches (1.2 m) above the finished floor to permit installation of perimeter safety cables prior to erection of the next tier, except where constructibility does not allow.

(B) The perimeter columns have holes or other devices in or attached to perimeter columns at 42-45 inches (107-114 cm) above the finished floor and the midpoint between the finished floor and the top cable to permit installation of perimeter safety cables (wire rope) required by subsection (I)(3) of this section, except where constructibility does not allow.

(h) Open web steel joists.

(1) General.

(2) Open web steel joists shall not be placed on any structural steel framework unless such framework is safely bolted or welded.

(3) In steel framing where bar joists are utilized and columns are not framed in at least two directions with structural steel members, a bar joist shall be field bolted at columns to provide lateral stability during construction.

(4) Where longspan joists or trusses, 40 feet or longer, are used rows of bridging shall be installed to provide lateral stability during construction prior to slacking of hoisting line.

(5) No load shall be placed on open web steel joists until these requirements are met.

(A) Except as provided in subsection (h)(1)(B) of this section, where steel joists are used and columns are not framed in at least two directions with solid web structural steel members, a steel joist shall be field-bolted at the column to provide lateral stability to the column during erection. For the installation of this joist:

1. A vertical stabilizer plate shall be provided on each column for steel joists. The plate shall be a minimum of 6 inch by 6 inch (152 mm by 152 mm) and shall extend at least 3 inches (76 mm) below the bottom chord of the joist with a 13/16 inch (21 mm) hole to provide an attachment point for guying or plumbing cables.

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2. The bottom chords of steel joists at columns shall be stabilized to prevent rotation during erection.

3. Hoisting cables shall not be released until the seat at each end of the steel joist is field-bolted, and each end of the bottom chord is restrained by the column stabilizer plate.

(B) Where constructibility does not allow a steel joist to be installed at the column:

1. An alternate means of stabilizing joists shall be installed on both sides near the column and shall:

a. Provide stability equivalent to subsection (h)(1)(A) of this section;

b. be designed by a qualified person;

c. be shop installed; and

d. be included in the erection drawings.

2. Hoisting cables shall not be released until the seat at each end of the steel joist is field-bolted and the joist is stabilized.

(C) Where steel joists at or near columns span 60 feet (18.3 m) or less, the joist shall be designed with sufficient strength to allow one employee to release the hoisting cable without the need for erection bridging.

(D) Where steel joists at or near columns span more than 60 feet (18.3 m), the joists shall be set in tandem with all bridging installed.

(E) A steel joist or steel joist girder shall not be placed on any support structure unless such structure is stabilized.

(F) When steel joist(s) are landed on a structure, they shall be secured to prevent unintentional displacement prior to installation.

(G) No modification that affects the strength of a steel joist or steel joist girder shall be made without the approval of the project structural engineer of record.

(H) Field-bolted joists.

1. Except for steel joists that have been pre-assembled into panels, connections of individual steel joists to steel structures in bays of 40 feet (12.2 m) or more shall be fabricated to allow for field bolting during erection.

2. These connections shall be field-bolted unless constructibility does not allow.

(I) Steel joists and steel joist girders shall not be used as anchorage points for a fall arrest system unless written approval to do so is obtained from a qualified person.

(J) A bridging terminus point shall be established before bridging is installed. (See Appendix A of this section.)

(2) Attachment of steel joists and steel joist girders.

(A) Each end of "K" series steel joists shall be attached to the support structure with a minimum of two 1/8-inch (3 mm) fillet welds 1 inch (25 mm) long or with two 1/2-inch (13 mm) bolts, or the equivalent.

(B) Each end of "LH" and "DLH" series steel joists and steel joist girders shall be attached to the support structure with a minimum of two 1/4-inch (6 mm) fillet welds 2 inches (51 mm) long, or with two 3/4-inch (19 mm) bolts, or the equivalent.

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(C) Except as provided in subsection (h)(2)(D) of this section, each steel joist shall be attached to the support structure, at least at one end on both sides of the seat, immediately upon placement in the final erection position and before additional joists are placed.

(D) Panels that have been pre-assembled from steel joists with bridging shall be attached to the structure at each corner before the hoisting cables are released.

(3) Erection of steel joists.

(A) Both sides of the seat of one end of each steel joist that requires bridging under Tables A and B shall be attached to the support structure before hoisting cables are released.

(B) For joists over 60 feet, both ends of the joist shall be attached as specified in subsection (h)(2) of this section and the provisions of subsection (h)(4) of this section met before the hoisting cables are released.

(C) On steel joists that do not require erection bridging under Tables A and B, only one employee shall be allowed on the joist until all bridging is installed and anchored.

(D) Employees shall not be allowed on steel joists where the span of the steel joist is equal to or greater than the span shown in Tables A and B except in accordance with subsection (h)(4) of this section.

(E) When permanent bridging terminus points cannot be used during erection, additional temporary bridging terminus points are required to provide stability. (See Appendix A of this section.)

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SHORT SPAN JOISTS**

Joist	Span - Feet
8K1 .....	NM
10K1 .....	NM
12K1 .....	23-0
12K3 .....	NM
12K5 .....	NM
14K1 .....	27-0
14K3 .....	NM
14K4 .....	NM
14K6 .....	NM
16K2 .....	29-0
16K3 .....	30-0
16K4 .....	32-0
16K5 .....	32-0
16K6 .....	NM
16K7 .....	NM
16K9 .....	NM
18K3 .....	31-0
18K4 .....	32-0
18K5 .....	33-0
18K6 .....	35-0
18K7 .....	NM
18K9 .....	NM
18K10 .....	NM
20K3 .....	32-0
20K4 .....	34-0
20K5 .....	34-0
20K6 .....	36-0
20K7 .....	39-0
20K9 .....	39-0
20K10 .....	NM
22K4 .....	34-0
22K5 .....	35-0
22K6 .....	36-0
22K7 .....	40-0
22K9 .....	40-0
22K10 .....	NM
22K11 .....	NM
24K4 .....	36-0
24K5 .....	38-0
24K6 .....	39-0
24K7 .....	43-0
24K8 .....	43-0
24K9 .....	44-0
24K10 .....	NM
24K12 .....	NM
26K5 .....	38-0
26K6 .....	39-0
26K7 .....	43-0
26K8 .....	44-0
26K9 .....	44-0
26K10 .....	49-0
26K12 .....	NM
28K6 .....	40-0
28K7 .....	43-0
28K8 .....	44-0
28K9 .....	45-0
28K10 .....	49-0

28K12 .....	53-0
30K7 .....	44-0
30K8 .....	45-0
30K9 .....	45-0
30K10 .....	50-0
30K11 .....	52-0
30K12 .....	54-0
10KCS1 .....	NM
10KCS2 .....	NM
10KCS3 .....	NM
12KCS1 .....	NM
12KCS2 .....	NM
12KCS3 .....	NM
14KCS1 .....	NM
14KCS2 .....	NM
14KCS3 .....	NM
16KCS2 .....	NM
16KCS3 .....	NM
16KCS4 .....	NM
16KCS5 .....	NM
18KCS2 .....	35-0
18KCS3 .....	NM
18KCS4 .....	NM
18KCS5 .....	NM
20KCS2 .....	36-0
20KCS3 .....	39-0
20KCS4 .....	NM
20KCS5 .....	NM
22KCS2 .....	36-0
22KCS3 .....	40-0
22KCS4 .....	NM
22KCS5 .....	NM
24KCS2 .....	39-0
24KCS3 .....	44-0
24KCS4 .....	NM
24KCS5 .....	NM
26KCS2 .....	39-0
26KCS3 .....	44-0
26KCS4 .....	NM
26KCS5 .....	NM
28KCS2 .....	40-0
28KCS3 .....	45-0
28KCS4 .....	53-0
28KCS5 .....	53-0
30KCS3 .....	45-0
30KCS4 .....	54-0
30KCS5 .....	54-0

NM=diagonal bolted bridging not mandatory.

**TABLE B.—ERECTION BRIDGING FOR  
LONG SPAN JOISTS**

Joist	Span - Feet
18LH02 .....	33-0.
18LH03 .....	NM.
18LH04 .....	NM.
18LH05 .....	NM.
18LH06 .....	NM.
18LH07 .....	NM.
18LH08 .....	NM.
18LH09 .....	NM.
20LH02 .....	33-0.
20LH03 .....	38-0.
20LH04 .....	NM.
20LH05 .....	NM.
20LH06 .....	NM.
20LH07 .....	NM.
20LH08 .....	NM.
20LH09 .....	NM.
20LH10 .....	NM.
24LH03 .....	35-0.
24LH04 .....	39-0.
24LH05 .....	40-0.
24LH06 .....	45-0.
24LH07 .....	NM.
24LH08 .....	NM.
24LH09 .....	NM.
24LH10 .....	NM.
24LH11 .....	NM.
28LH05 .....	42-0.
28LH06 .....	46-0.
28LH07 .....	54-0
28LH08 .....	54-0
28LH09 .....	NM.
28LH10 .....	NM.
28LH11 .....	NM.
28LH12 .....	NM.
28LH13 .....	NM.
32LH06 .....	47-0 through 60-0.
32LH07 .....	47-0 through 60-0.
32LH08 .....	55-0 through 60-0.
32LH09 .....	NM through 60-0.
32LH10 .....	NM through 60-0.
32LH11 .....	NM through 60-0.
32LH12 .....	NM through 60-0.
32LH13 .....	NM through 60-0.
32LH14 .....	NM through 60-0.
32LH15 .....	NM through 60-0.
36LH07 .....	47-0 through 60-0.
36LH08 .....	47-0 through 60-0.
36LH09 .....	57-0 through 60-0.
36LH10 .....	NM through 60-0.
36LH11 .....	NM through 60-0.
36LH12 .....	NM through 60-0.
36LH13 .....	NM through 60-0.
36LH14 .....	NM through 60-0.
36LH15 .....	NM through 60-0.

NM = diagonal bolted bridging not mandatory.

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(4) Erection bridging.

(A) Where the span of the steel joist is equal to or greater than the span shown in Tables A and B, the following shall apply:

1. A row of bolted diagonal erection bridging shall be installed near the midspan of the steel joist;
2. Hoisting cables shall not be released until this bolted diagonal erection bridging is installed and anchored; and
3. No more than one employee shall be allowed on these spans until all other bridging is installed and anchored.

(B) Where the span of the steel joist is over 60 feet (18.3 m) through 100 feet (30.5 m), the following shall apply:

1. All rows of bridging shall be bolted diagonal bridging;
2. Two rows of bolted diagonal erection bridging shall be installed near the third points of the steel joist;
3. Hoisting cables shall not be released until this bolted diagonal erection bridging is installed and anchored; and
4. No more than two employees shall be allowed on these spans until all other bridging is installed and anchored.

(C) Where the span of the steel joist is over 100 feet (30.5 m) through 144 feet (43.9 m), the following shall apply:

1. All rows of bridging shall be bolted diagonal bridging;
2. Hoisting cables shall not be released until all bridging is installed and anchored; and
3. No more than two employees shall be allowed on these spans until all bridging is installed and anchored.

(D) For steel members spanning over 144 feet (43.9 m), the erection methods used shall be in accordance with subsection (g) of this section.

(E) Where any steel joist specified in subsections (h)(3)(B) and (h)(4)(A), (h)(4)(B), and (h)(4)(C) of this section is a bottom chord bearing joist, a row of bolted diagonal bridging shall be provided near the support(s). This bridging shall be installed and anchored before the hoisting cable(s) is released.

(F) When bolted diagonal erection bridging is required by this section, the following shall apply:

1. The bridging shall be indicated on the erection drawing;
2. The erection drawing shall be the exclusive indicator of the proper placement of this bridging;
3. Shop-installed bridging clips, or functional equivalents, shall be used where the bridging bolts to the steel joists;
4. When two pieces of bridging are attached to the steel joist by a common bolt, the nut that secures the first piece of bridging shall not be removed from the bolt for the attachment of the second; and
5. Bridging attachments shall not protrude above the top chord of the steel joist.

(5) Landing and placing loads.



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(A) During the construction period, the employer placing a load on steel joists shall ensure that the load is distributed so as not to exceed the carrying capacity of any steel joist.

(B) Except for subsection (h)(5)(E) of this section, no construction loads are allowed on the steel joists until all bridging is installed and anchored and all joist-bearing ends are attached.

(C) The weight of a bundle of joist bridging shall not exceed a total of 1,000 pounds (454 kg). A bundle of joist bridging shall be placed on a minimum of three steel joists that are secured at one end. The edge of the bridging bundle shall be positioned within 1 foot (.30 m) of the secured end.

(D) Metal decking bundles shall be landed on framing members so that enough support is provided to allow the bundles to be unbanded without dislodging the bundles from the supports.

(E) No bundle of decking may be placed on steel joists until all bridging has been installed and anchored and all joist bearing ends attached, unless all of the following conditions are met:

1. The employer has first determined from a qualified person and documented in an erection plan that the structure or portion of the structure is capable of supporting the load;

2. The bundle of decking is placed on a minimum of three steel joists;

3. The joists supporting the bundle of decking are attached at both ends;

4. At least one row of bridging is installed and anchored;

5. The total weight of the bundle of decking does not exceed 4,000 pounds (1816 kg); and

6. Placement of the bundle of decking shall be in accordance with subsection (h)(5)(F) of this section.

(F) The edge of the construction load shall be placed within 1 foot (.30 m) of the bearing surface of the joist end.

(i) Systems-engineered metal buildings.

(1) All of the requirements of this section apply to the erection of systems-engineered metal buildings except subsection (f) (column anchorage) and subsection (h) (open web steel joists).

(2) Each structural column shall be anchored by a minimum of four anchor rods (anchor bolts).

(3) Rigid frames shall have 50 percent of their bolts or the number of bolts specified by the manufacturer (whichever is greater) installed and tightened on both sides of the web adjacent to each flange before the hoisting equipment is released.

(4) Construction loads shall not be placed on any structural steel framework unless such framework is safely bolted, welded or otherwise adequately secured.

(5) In girt and eave strut-to-frame connections, when girts or eave struts share common connection holes, at least one bolt with its wrench-tight nut shall remain connected to the first member unless a manufacturer-supplied, field-attached seat or similar connection device is present to secure the first member so that the girt or eave strut is always secured against displacement.

(6) Both ends of all steel joists or cold-formed joists shall be fully bolted and/or welded to the support structure before:

(A) Releasing the hoisting cables;

(B) Allowing an employee on the joists; or

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(C) Allowing any construction loads on the joists.

(7) Purlins may only be used as a walking/working surface when installing safety systems, after all permanent bridging has been installed and fall protection is provided.

(8) Construction loads may be placed only within a zone that is within 8 feet (2.5 m) of the center-line of the primary support member.

(j) Falling object protection.

(1) Securing loose items aloft. All materials, equipment, and tools, which are not in use while aloft, shall be secured against accidental displacement.

(2) Protection from falling objects other than materials being hoisted. The controlling contractor shall bar other construction processes below steel erection unless overhead protection for the employees below is provided.

~~(d)~~ (k) Permanent Flooring--Skeleton Steel Construction in Tiered Buildings.

(1) The permanent floors shall be installed as the erection of structural members progresses, and there shall be not more than eight stories between the erection floor and the uppermost permanent floor, except where the structural integrity is maintained as a result of the design.

(2) At no time shall there be more than four floors or 48 feet of unfinished bolting or welding above the foundation or uppermost permanently secured floor.

~~(e)~~ (l) Temporary Flooring--Skeleton Steel Construction in Multistory Buildings.

(1) The derrick or erection floor shall be solidly planked or decked except for access openings. Planking or decking of equivalent strength, shall be of proper thickness to carry the working load. Planking shall be not less than 2 inches thick full size undressed, and shall be laid tight. Both planking and decking shall be secured.

(2) On buildings or structures not adaptable to temporary floors, and where scaffolds or ~~safety belt~~ approved fall protection is not used, safety nets shall be installed and maintained whenever the potential fall distance exceeds two stories or 30 feet, whichever is less.

(3) The exposed edges of all temporary planked ~~or and temporary~~ metal decked floors at the periphery of the building, ~~or portion of a building exceeding 30 feet in height~~, or at interior openings, such as stairways and elevator shafts shall be protected by a single 3/8-inch minimum diameter wire rope of 13,500 pounds minimum breaking strength located between 42 and 45 inches above design finish floor height. Other guardrail protection may be used if equal fall protection is provided. Midrail protection shall be installed at the completion of the installation of decking.

NOTE: If the periphery fall protection is intended to be used as a catenary line, it shall meet the provisions of Section 1710~~(g)~~~~(4)~~~~(m)~~~~(4)~~.

(4) Framed metal deck openings shall have structural members turned down to allow continuous deck installation except where not allowed by structural design constraints or constructibility.

(5) Metal decking holes and openings shall not be cut until immediately prior to being permanently filled with the equipment or structure needed or intended to fulfill its specific use and which meets the strength requirements of Section 1632(b) of these orders, or shall be immediately covered.

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~~(4)~~ (6) Where skeleton steel is being erected, a tightly planked and substantial floor shall be maintained within two stories or 30 feet, whichever is less, below and directly under that portion of each tier of beams on which any work is being performed.

~~EXCEPTION: When gathering and stacking temporary floor planks on a lower floor in preparation for transferring planks for use on an upper floor.~~

NOTE: Where a planked floor is not practical, ~~Subsection (e)(1)~~(2) of this section applies.

(A) When gathering and stacking temporary floor planks, the planks shall be removed successively, working toward the last panel of the temporary floor so that the work is always done from the planked floor.

(B) When gathering and stacking temporary floor planks from the last panel, the employees assigned to such work shall be protected by ~~safety belts with safety lines~~ approved personal fall protection devices attached to a catenary line or other substantial anchorage.

~~(f) Flooring—Other Construction.~~

~~(1) In the erection of a building having double wood floor construction, the rough flooring shall be completed as the building progresses, including the tier below the one on which floor joists are being installed.~~

~~(2) For single wood floor or other flooring systems, the floor immediately below the story where the floor joists are being installed shall be kept planked or decked over.~~

~~(g)~~ (m) Working and Traveling on the Skeleton Steel of Multistory Buildings or Structures.

(1) Connecting.

When connecting beams at the periphery or interior of a building or structure where the fall distance is greater than two stories or 30 feet, whichever is less, iron workers shall be provided with and use a personal fall protection system as described in Article 24 tied-off to either columns, pendant lines secured at the tops of columns, catenary lines, or other secure anchorage points.

(2) Work Other Than Connecting.

When performing any other work at a work point, iron workers shall be provided with and use personal fall protection as described in Article 24 where the fall distance is greater than 15 feet.

(3) Traveling at Periphery or Interior of Building.

(A) When moving from work point to work point or releasing slings, iron workers shall be permitted to walk the top flange of a beam when the fall distance is not more than 30 feet or two stories, whichever is or less.

(B) When the fall distance is greater than 30 feet, or two stories, whichever is less, iron workers:

1. Shall coon or walk the bottom flange (inside flange or peripheral beams), or
2. May walk the top flange if they are tied-off to catenary lines.

(4) Pendant lines, catenary lines and other lines used to secure workers shall be ~~capable of supporting a minimum weight of 5400 pounds~~ used in accordance with the Construction Safety Orders, Section 1670.

(5) If the procedure specified in subsection (m)(1) above is impractical, perimeter safety nets shall be installed at a distance of no more than 25 feet below the work surface and extend at least

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8 feet beyond the perimeter of the building or structure. Nets shall meet the requirements set forth in accordance with Sections 1671 ~~and 1672~~.

~~NOTE: As used in subsection (g), iron worker(s) refers to employees who are engaged in multistory building steel erection. Activities include hoisting, connecting, welding, bolting, and rigging structural steel, steel joists and metal buildings; installing metal deck, siding systems, miscellaneous metals, ornamental iron and similar materials; and moving from point to point to perform these activities.~~

(n) Custody of fall protection. Fall protection provided by the steel erector shall remain in the area where steel erection activity has been completed, to be used by other trades, only if the controlling contractor or its authorized representative:

(1) Has directed the steel erector to leave the fall protection in place; and

(2) Has inspected and accepted control and responsibility of the fall protection prior to authorizing persons other than steel erectors to work in the area.

(o) Smoke dome or skylight fixtures that have been installed, are not considered covers for the purpose of this section unless they meet the strength requirements of Section 1632(b) of these orders.

~~(h) Buildings or Other Structures with Large, Open Spans.~~

~~Employees working on buildings or other structures with large, open spans or areas, such as mill buildings, gymnasiums, auditoriums, hangars, arenas, stadiums and bridges, shall be protected from the hazard of falling in accordance with Sections 1669, 1670 and 1671 when the fall height exceeds 30 feet.~~

~~(i) Wood-frame Construction, Residential/Commercial.~~

~~(1) Before manually raising wood framed walls that are 10 feet or more in height, temporary restraints such as cleats on the foundation/floor system or straps on the wall bottom plate shall be installed to prevent inadvertent horizontal sliding or uplift of the wood framed wall bottom plate.~~

~~(2) Anchor bolts shall not be used for blocking or bracing the wood framed wall being raised.~~

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Sections 142.3, 7252, 7253, 7254, 7258, 7261, 7262 and 7266, Labor Code.

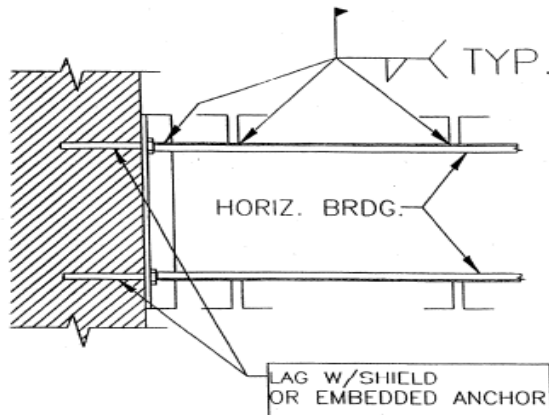
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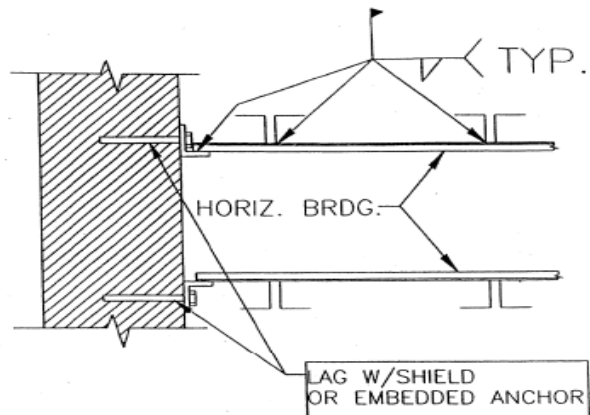
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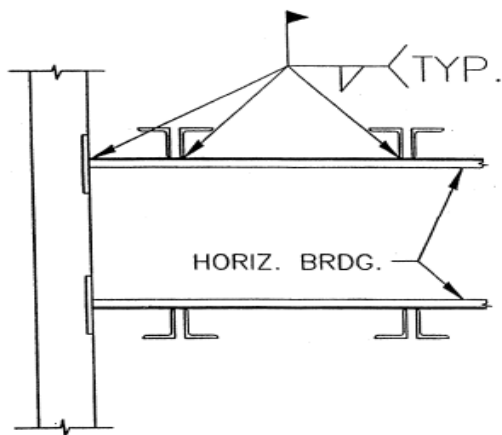
**Appendix A to Section 1710 – Illustrations of Bridging Terminus Points: Non-mandatory Guidelines for Complying with Sections 1710(h)(1)(J) and 1710(h)(2)(E).**



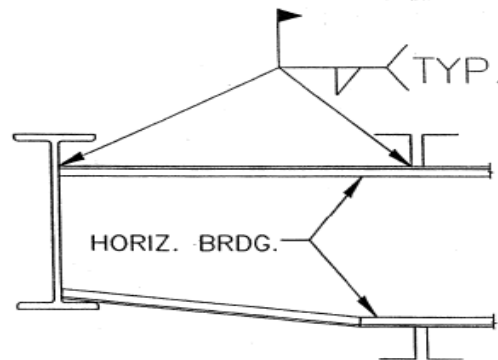
HORIZONTAL BRIDGING  
TERMINUS AT WALL



HORIZONTAL BRIDGING  
TERMINUS AT WALL



HORIZONTAL BRIDGING  
TERMINUS AT PANEL WALL



HORIZONTAL BRIDGING  
TERMINUS AT  
STRUCTURAL SHAPE

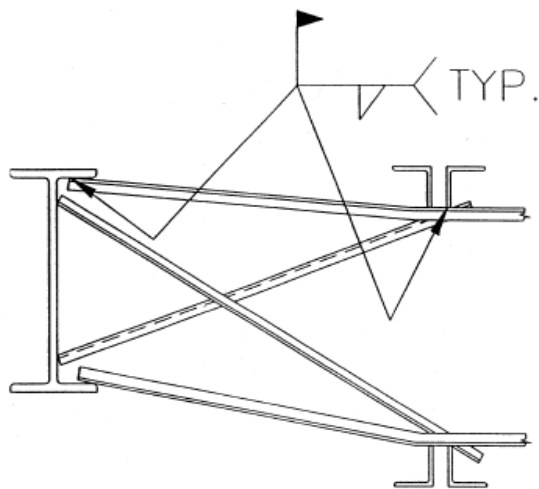
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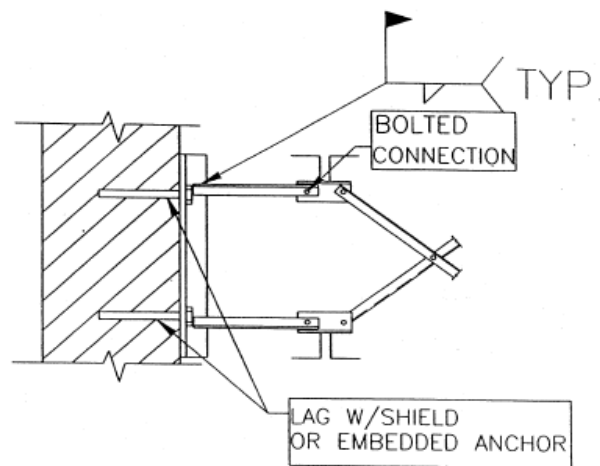
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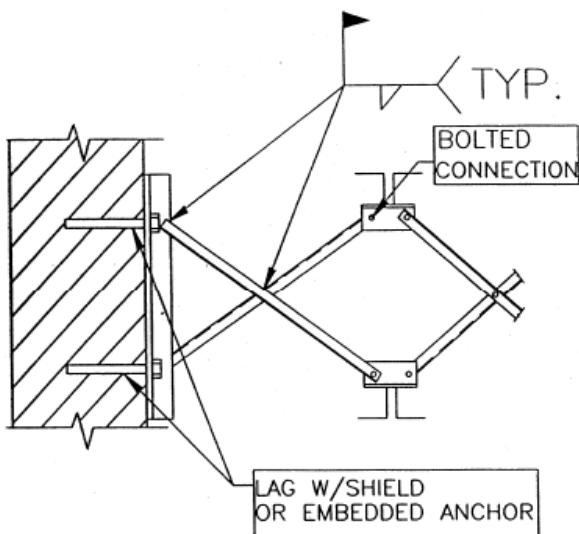
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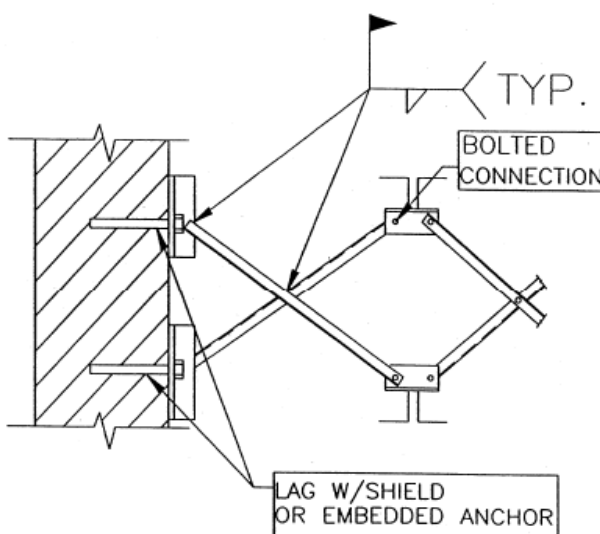
HORIZONTAL BRIDGING  
 TERMINUS AT STRUCTURAL  
 SHAPE WITH OPTIONAL  
 "X-BRIDGING"



BOLTED DIAGONAL BRIDGING  
 TERMINUS AT WALL



BOLTED DIAGONAL BRIDGING  
 TERMINUS AT WALL



BOLTED DIAGONAL BRIDGING  
 TERMINUS AT WALL

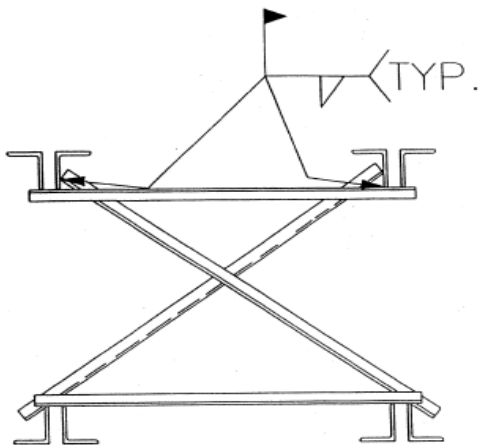
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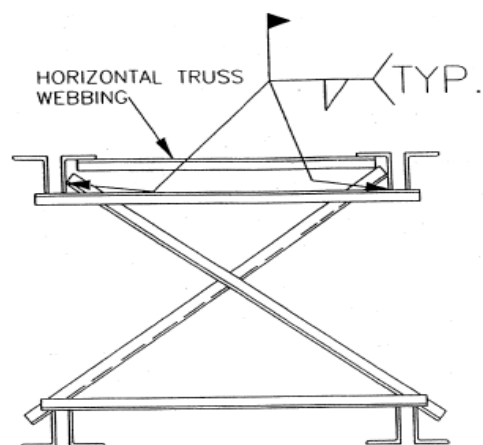
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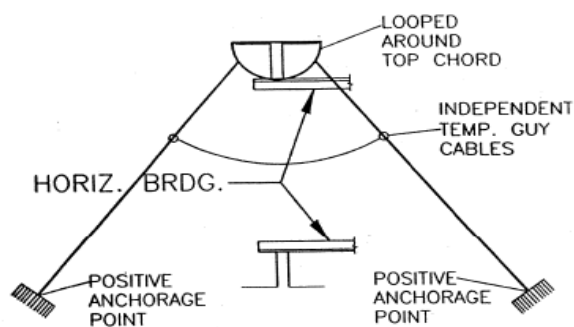
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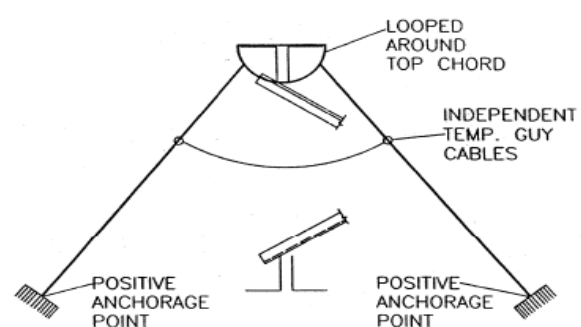
JOISTS PAIR BRIDGING  
TERMINUS POINT



JOISTS PAIR BRIDGING  
TERMINUS POINT  
W/HORIZ. TRUSS



HORIZONTAL BRIDGING  
TERMINUS POINT  
SECURED BY TEMP.  
GUY CABLES



DIAGONAL BRIDGING  
TERMINUS POINT  
SECURED BY TEMP.  
GUY CABLES

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

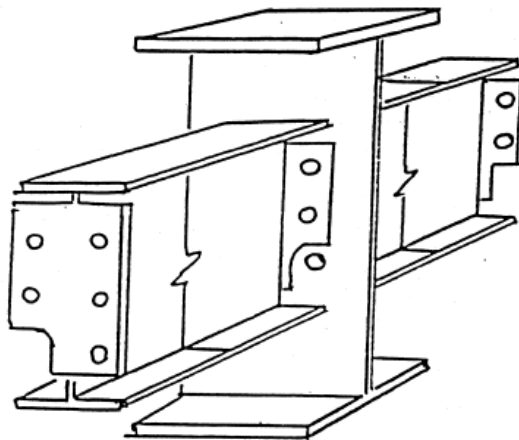
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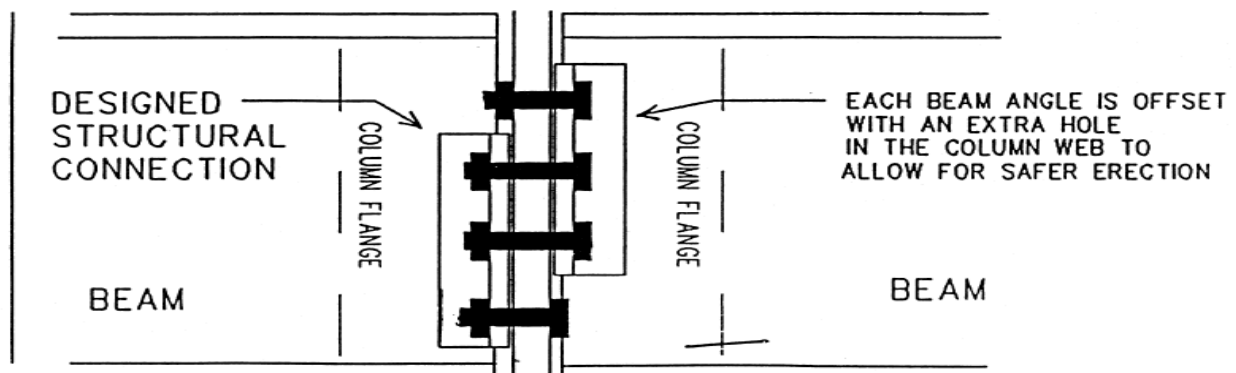
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**Appendix B to Section 1710 – Double Connections: Illustrations of a Clipped End Connection and a Staggered Connection: Non-Mandatory Guidelines for Complying with Section 1710(g)(4).**



Clipped end connections are connection material on the end of a structural member which has a notch at the bottom and/or top to allow the bolt(s) of the first member placed on the opposite side of the central member to remain in place. The notch(es) fits around the nut or bolt head of the opposing member to allow the second member to be bolted up without removing the bolt(s) holding the first member.



Staggered connections are connection material on a structural member in which all of the bolt holes in the common member web are not shared by the two incoming members in the final connection. The extra hole in the column web allows the erector to maintain at least a one bolt connection at all times while making the double connection.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.



**STANDARDS PRESENTATION**  
**TO**  
**CALIFORNIA OCCUPATIONAL SAFETY AND HEALTH STANDARDS BOARD**

Attachment No. 1

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PROPOSED STATE STANDARD,  
TITLE 8, CHAPTER 4

Add new Section 1716.2 to read:

§1716.2 Wood-frame Construction, Residential/Commercial.

- (a) Before manually raising wood framed walls that are 10 feet or more in height, temporary restraints such as cleats on the foundation/floor system or straps on the wall bottom plate shall be installed to prevent inadvertent horizontal sliding or uplift of the wood framed wall bottom plate.
- (b) Anchor bolts shall not be used for blocking or bracing the wood framed wall being raised.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.